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Systematic Review of the Literature

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Can contact lens use influence the progression of keratoconus?

A adaptação de lentes de contato pode influenciar a progressão do ceratocone?

¿La adaptación de lentes de contacto puede influenciar el avance del queratocono?

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ABSTRACT

Purpose: To assess whether contact lens (CL) use influences the progression of keratoconus. **Methods:** Systematic review of literature published up to April 2015 by searching in Medline, Embase, LILACS-SciELO, and Cochrane Library databases. **Results:** Eight relevant studies were selected. **Conclusion:** No evidence supported the hypothesis that CLs stabilize the progression of keratoconus. However, CL use may be associated with the progression of keratoconus and scar development.

RESUMO

Objetivo: Avaliar se a adaptação de lente de contato influencia a progressão do ceratocone. **Método:** revisão sistemática da literatura através das bases de dados Medline, Embase, Lilacs/Scielo, Cochrane Library até abril de 2015. **Resultados:** os resultados desta revisão basearam-se em dados de oito estudos. **Conclusão:** não há evidências que comprovem benefício das lentes de contato em relação a estabilizar a progressão do ceratocone. Por outro lado, o uso de lentes de contato pode estar associado a maior risco de progressão e desenvolvimento de cicatriz.

RESUMEN

Objetivo: Evaluar si la adaptación de lentes de contacto influye en el avance del queratocono. **Método:** revisión sistemática de la literatura a través de las bases de datos Medline, Embase, Lilacs/Scielo, Cochrane Library, hasta abril de 2015. **Resultados:** los resultados de esta revisión se basaron en dados de ocho estudios. **Conclusión:** no hay evidencias que comprueben el beneficio de los lentes de contacto para la estabilización del avance del queratocono. Por otro lado, el uso de lentes de contacto puede estar asociado a un mayor riesgo de progresión y desarrollo de cicatriz.

Keywords:
Cornea.
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Palavras-chave:
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INTRODUCTION

Keratoconus is a non-inflammatory progressive corneal ectatic disorder characterized by changes in the organization and structure of corneal collagen.[1] A reduction in number of covalent collagen crosslinks and increase in pepsin digestion weaken the structure of the corneal tissue. The resultant low collagen rigidity is typically only 60% of that of normal cornea. This causes the cornea to undergo progressive bulging and thinning, resulting in irregular astigmatism and apex thinning.[2] Essa ectasia pode ocorrer na parte central, paracentral ou periférica da córnea. Keratoconus can occur in the central, near-central, or peripheral parts of the cornea. The disorder can stabilize after a few years, or it can progress and cause scarring, thus resulting in substantial vision loss.[3,4]

The prevalence of keratoconus varies from 50 to 230 cases per 100,000 individuals, with no predominance among sexes or races. In most cases, it is bilateral, although its manifestations are asymmetrical.[3] The disorder develops during adolescence and progresses at varied rates until the fourth decade of life, when it typically stabilizes or progresses minimally.[3]

Visual correction depends on the severity of the disorder and the needs of the patient. In 15% of cases, corrective lens use is unnecessary and eyeglass use can be sufficient. In approximately 70% of cases, rigid gas-permeable (RGP) contact lenses (CLs) are used to correct patient vision because the CLs provide a regular refractive surface that compensates for distortions to the anterior corneal surface. This corrects high-order optical aberrations, including coma, trefoil, and spherical aberrations.[4]

Keratoconus can stabilize after a few years or can progress to form corneal scars causing significant vision impairment and CL use is associated with epithelial erosion, corneal opacity, and worsened vision; hence, conducting a risk analysis based on the best evidence currently available on the safety of CL use by keratoconus patients is necessary. Thus, using the model for systematic reviews of the literature set forth by the Guidelines Project of the Brazilian Medical Association (AMB), a systematic review was conducted to search for evidence of whether CL use has any influence on the progression of keratoconus.

OBJECTIVE

To determine whether that CL use influences the progression of keratoconus through a systematic review of literature.

METHODS

To obtain evidence to determine whether CL use influences the progression of keratoconus, the clinical issue was established; then, a question was structured, literature search and clinical evaluations were performed, and evidence was selected.[5]

THE PATIENT/PROBLEM, INTERVENTION, COMPARISON, AND OUTCOME (PICO) PROCESS.

Using the model for systematic reviews of the literature set forth by the Guidelines Project of the AMB, the following question was structured based on the PICO process:

IS THERE ANY EVIDENCE THAT CONTACT LENS USE INFLUENCES THE PROGRESSION OF KERATOCONUS?

RESEARCH STRATEGIES

Based on the abovementioned question, the search for evidence was performed using primary scientific databases (Medline, Embase, LILACS-SciELO, and Cochrane Library) up to April 2015. The Medline database was consulted through PubMed using the following research strategies:

- **Strategy 1:** (Keratoconus OR Ectasia OR Keratoectasia) AND (Contact Lenses, Hydrophilic OR Contact Lens, Hydrophilic OR Soft Contact Lenses OR Soft Contact Lens OR Contact Lenses OR Contact Lens OR Contact Lenses, Extended-Wear). A total of 975 publications were obtained using this strategy.
- **Strategy 2:** (Keratoconus OR Ectasia OR Keratoectasia) AND (Contact Lenses, Hydrophilic OR Contact Lens, Hydrophilic OR Soft Contact Lenses OR Soft Contact Lens OR Contact Lenses OR Contact Lens OR Contact Lenses, Extended-Wear) AND

((Therapy/broad[filter] OR Prognosis/broad[filter] OR Comparative study OR Comparative studies)). A total of 517 publications were obtained using this strategy.

Strategies #1 OR #2. Using the combination of both strategies, 975 publications were selected.

Methodological Quality. The obtained evidence was selected based on a critical evaluation, which relied on the Jadad scale,[6] GRADE system for Randomized Clinical Trials,[7] and Newcastle-Ottawa scale for observational studies.[8] The studies, which could fulfill the recommendations were defined; thereafter, they were graded using the Jadad classification, and the strongest evidence was included.[9]

The levels of recommendation and evidence strength used were as follows: (**A**) highly consistent experimental or observational studies, (**B**) experimental or observational studies of low consistency, (**C**) case reports (non-controlled studies), and (**D**) opinions without critical appraisal, based on consensus, physiology studies, or animal models.

Of the 975 articles obtained using the research strategy, 60 publications were selected as epidemiological studies. Of these, 52 were excluded because they were not linked to the PICO process or because their evidence strength was low.

RESULTS

In patients with keratoconus, the presence of central corneal scarring impaired high- and low-contrast monocular visual acuities, with greater impairment at low contrast (mean 25.2 ± 14.2 correct letters for scarred eyes, compared with 35.9 ± 10.8 correct letters for unscarred eyes)[10](**C**).

In patients with keratoconus, habitual RGP CL use increased the risk of corneal scarring (corneal leukoma) by 16% [Number Needed to Harm 6; odds ratio (OR) 3.62]. Discontinuing CL use was more frequent in patients with injury (5% increase, OR 1.11); the time of use was longer in patients with scarring than in patients without scarring (13.6 ± 3.8 vs. 12.5 ± 4.5, OR 1.08). During a five-year follow-up period, the average size of central corneal scars was 1.4 ± 0.7 mm and the mean density was 1.8 ± 0.65 mm. One factor significantly associated with increased the risk of scarring was CL use [OR 2.50, 95% confidence interval (CI) 1.40–4.76]. In different groups of corneal curvature, the incidence of scarring over five years was higher in patients using CLs compared with patients not using CLs. The incidence of scarring in patients using CLs increased as corneal curvature increased. The overall incidence of corneal scarring was 13.7%: patients using CLs, 16.7%; patients using CL and having a corneal curvature of >52 D, 38.0% (OR 4.79, 95% CI 3.08–7.45, P < 0.001). After eight-year follow-up, 41% of patients using RGP CL showed scarring compared with 24% in patients not using CL (OR 2.15, 95% CI 1.35–3.43, P = 0.001). A higher proportion of corneas fitted with CL whose CL–cornea relationship was considered flat (apical touch) showed scarring: 43% compared with 26% for eyes adapted to tighter CL and with less apical touch (OR 2.19, 95% CI 1.37–3.51, P = 0.001). CL use in more advanced keratoconus (more curved corneal meridians) increased the risk of corneal scarring by 28% along with the diopter curvature increase (OR 1.28, 95% CI 1.23–1.34, P = 0.0001)[11-14](**B**).

The Collaborative Longitudinal Evaluation of Keratoconus (CLEK) study identified factors associated with comfort in using RGP CL (n = 751) and included the following variables: degree of keratoconus (steepest corneal meridian), corrected visual acuity (with CL), RGP CL parameters (base curve radius, lens power, center thickness, and overall diameter of the optic zone), time of using CL, CL–cornea relationship (classified using fluorescein standard, considering apical and peripheral clearance), presence of corneal scarring, corneal staining with fluorescein, and comfort [scaled from 1 (very comfortable) to 5 (significant irritation)]. The CLEK results showed a 41% higher probability of comfort for each decade CLs were used. In addition, better visual acuity was associated with greater comfort in CL use, with 12% greater probability of comfort with CLs for every five additional letters stated during assessment of high-contrast visual acuity. Comfort in CL use was associated with a 16%–17% increase for each additional hour using CLs per day during the week. Patients who frequently removed their CLs had a 50% probability of comfort in CL use. Compared with those using apical and peripheral clearance evaluated as average, patients using apical and peripheral clearance within the acceptable minimum range had a 50% probability of good degrees of comfort with CLs (OR 0.39, 95% CI 0.19–0.79). Corneal measurements (steepest meridian and base curve lens associated with the onset of apical clearance—Definite Apical Clearance First Lens), base curve, total diameter, presence of corneal scarring, corneal

staining with fluorescein, presence of papillae in the tarsal conjunctiva, and presence of CL imprint on the cornea were not associated with comfort in CL use[14](B).

Patients with keratoconus and acute corneal hydrops, defined as sudden occurrence of bullous corneal edema, were compared with a group of patients with keratoconus but with no history of acute corneal hydrops. CL use before the occurrence of hydrops was found in 50% of cases compared with 70% of patients without hydrops (P = 0.139). Mean visual acuity (LogMAR) in eyes subsequently affected by hydrops was 1.14 ± 0.63 (6/72 Snellen), which was significantly lower (P < 0.001) than that in patients without acute corneal hydrops (LogMAR 0.63 ± 0.46, Snellen 6/24)[15](B).

Each patient defined as having keratoconus showed one or more of the following clinical signs: stromal thinning, vertical stress lines (Vogt striae), and Fleischer ring or external signs (Munson's sign or Rizzuti's phenomenon). Patients with keratoconus were divided into two groups: RGP CL users and those not using CL. The average number of years using CLs was 7.08 ± 7.35 years. Two other groups of patients were analyzed for comparison: individuals with no eye disease or CL use and patients using CLs for astigmatism/myopia. Basal epithelial cell density was significantly lower in CL users with keratoconus (P < 0.001) and in patients with keratoconus not using CL (P < 0.001) than in their respective comparison groups. The densities of anterior, intermediary, and posterior keratocytes were significantly lower in both groups of patients with keratoconus, whether they used CLs (all P < 0.001) or did not use CLs (P < 0.001, P < 0.001, and P = 0.004, respectively) versus patients in the respective comparison groups[16](B).

Keratoconus patients using RGP CLs were compared with patients who did not use CLs. In the first evaluation, LogMAR of visual acuities of CL users and non-users with best optical correction were 0.68 ± 0.61 and 0.54 ± 0.47, respectively (P = 0.255). In CL users, LogMAR visual acuity improved significantly by –0.016 ± 0.065 (P < 0.001) after adjustment with multicurve RGP CLs. At the end of follow-up period, RGP CL use increased LogMAR visual acuity by 0.032 ± 0.10 (P = 0.05). CL use was reported as comfortable in 87% of cases, slightly uncomfortable in 9.1%, and uncomfortable in 3.9%. Mean daily use was of 11.6 ± 3.0 h. The incidence of punctate keratitis, including transient and persistent erosions, in patients using and not using CLs was 41.6% and 6.6%, respectively (P < 0.001). In CL users, LogMAR visual acuity improved significantly from –0.016 ± 0.065 to –0.032 ± 0.10 during follow-up (P = 0.05). In patients with advanced keratoconus and CL users, the topographic parameters were significantly reduced (Sim-Kmax and Sim-Kmin, apical power, astigmatism index, and anterior elevation; P < 0.05). Meanwhile, in patients not using CLs, apical power and irregularity index increased from 55.56 ± 7.25 and 3.06 ± 1.68 D to 57.11 ± 7.75 and 3.25 ± 1.71 D, respectively (P = 0.008 and 0.01, respectively)[17](B).

CONCLUSION

No evidence proved the benefits of CLs in relation to stabilizing progression of keratoconus. Although the use of special CLs such as RGP CLs in patients with keratoconus provided improved visual acuity, their use may be associated with increased incidence of opacities (scarring) in the cornea, particularly in more advanced cases of keratoconus, thus resulting in worsened keratoconus. Nevertheless, RGP CL use, which avoids or minimizes apical contact, appeared to reduce this adverse effect.

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